

on that wheel ; without it the milled head is too free to feel pleasant when bisecting a star image carefully and accurately.

The adjustment of focus and of the scale—that is, the graduations on the circles—to be exactly equal to a réseau square, five millimetres, is provided for by the compound screws K K K K (*Fig. II.*), and the focal adjustment of the microscope.

The chambers shown in Plate 6 are $\frac{1}{4}$ -inch thick, are made of cast-iron, and are *dust proof*, thus keeping the changes of temperature very slow, and the effect as far as possible uniform over all the measuring parts.

Little need be said of the sliding frames for placing a réseau square in its place. There is a large hole as close to the micrometer J and as near that point as possible, so that a spot of the réseau plate under and about the microscope is easily seen for placing any part under the microscopes.

Fig. III. (Plate 5) shows the arrangement of the slides for adjusting the photograph ; one \wedge guide controls the straight-line motion with perfect accuracy, the other support is on friction rollers, and the wire over the pulley carries a balance weight. The motion is all that can be desired ; the cross slide hangs on the upper edge of the larger slide, and works very satisfactorily.

Sydney Observatory : 1902 July 29.

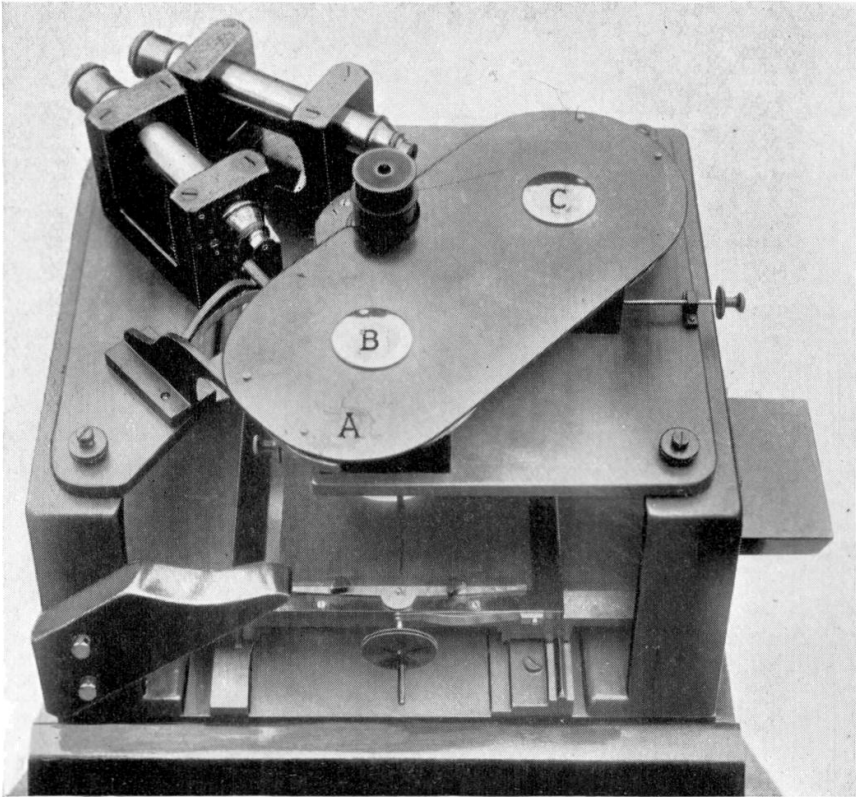
A Standard Scale for Telescopic Observations. By Percival Lowell.

(Communicated by the Secretaries.)

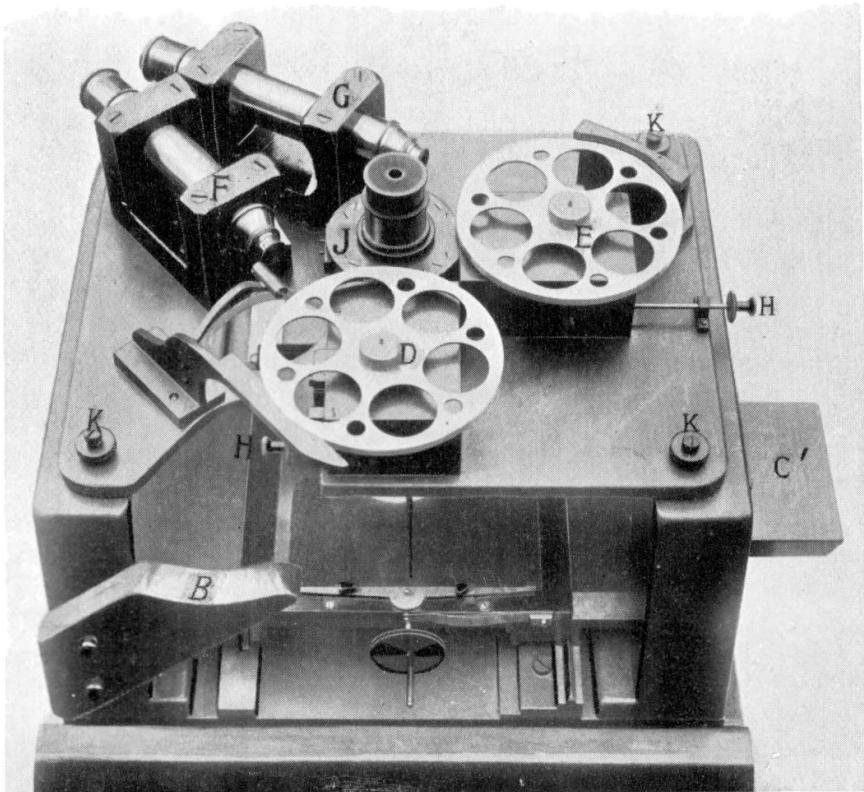
1. *Present State.*—At present there exists no criterion among astronomers for the weight to be attached to any given observation due to the atmospheric conditions under which it is made. Yet these atmospheric conditions are among the most important factors entering into an astronomic observation. They are far more to the point than the size of the instrument. For our telescopes have long since outstripped the conditions under which they are put to work ; the great bar to advance to-day, whether visually, photographically, or spectroscopically, being not instrument but atmosphere. Each man realises this, but marks his own work on his own scale, as if he should take his own foot as the unit of length.

2. *Difficulties of this Condition.*—In consequence no absolute value is assignable to any man's work, and no comparison between different men's work is possible whether in accuracy or credibility. The practical outcome is that the only test is the

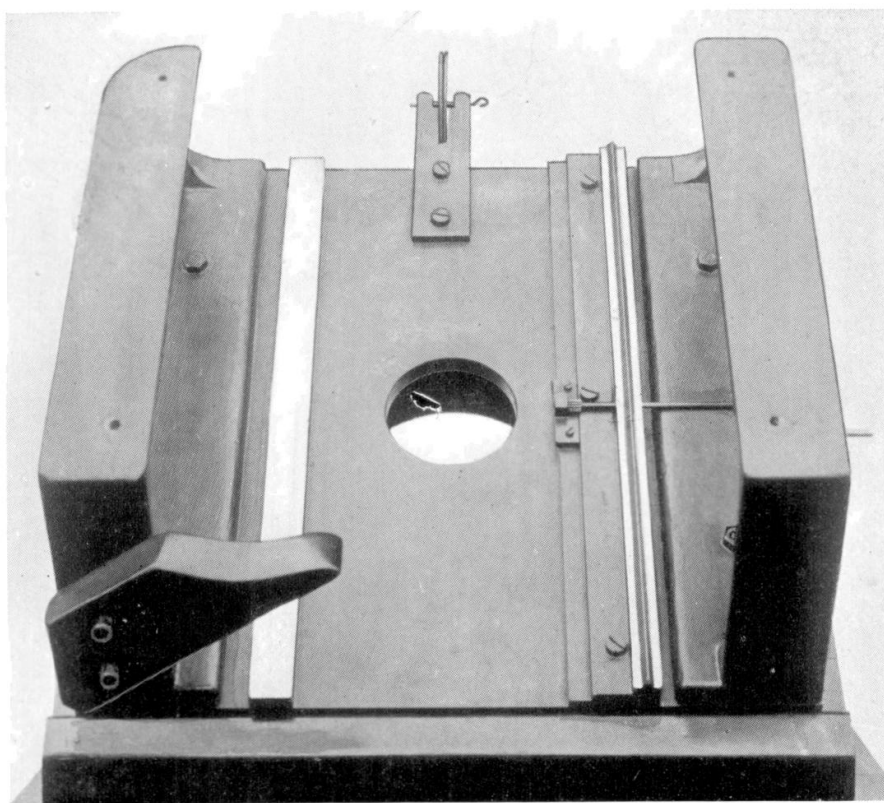
I.



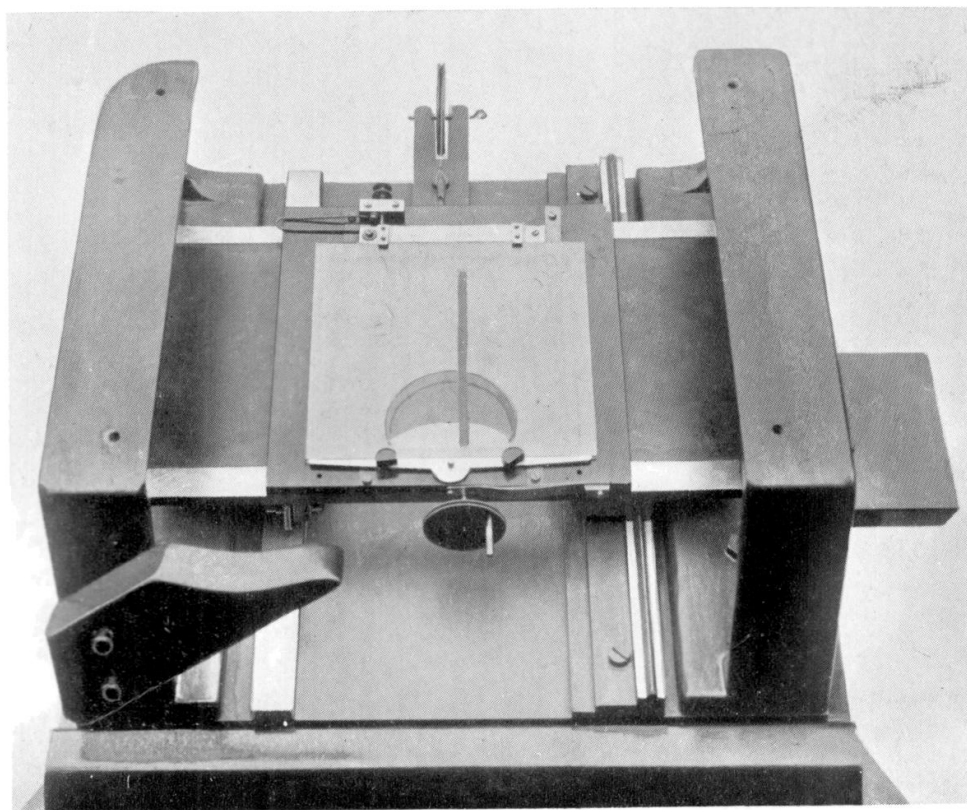
II.



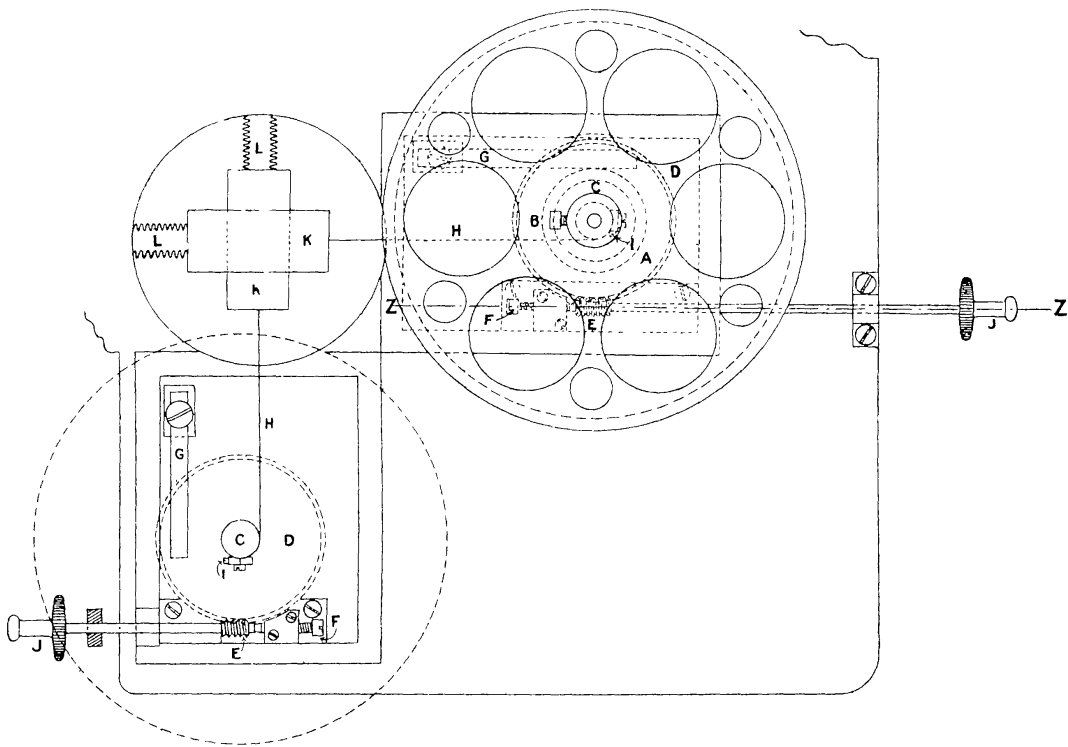
III.



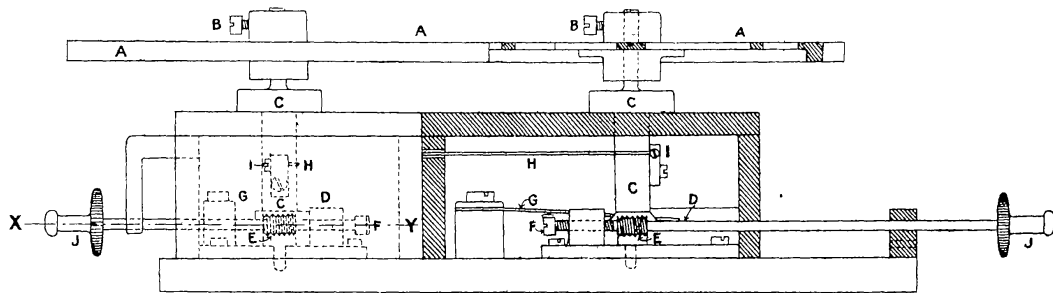
IV.



PLAN AND SECTION ON XY



ELEVATION AND SECTION ON ZZ



test of time, and while the world is waiting for confirmation of any new result just so many years are lost.

As important is the incapacity to leave permanent records of observations capable of being compared with newer ones as time rolls on.

3. *A Change necessary.*—A change in this state of things is imperatively needed. It is time a standard scale for observations were introduced similar to what the metric system is, that it may do what that does for physics generally.

4. *Possibility of a Criterion.*—Until lately such a scale has not been feasible owing to ignorance of the conditions upon which it must be based. Studies, however, directed to that end first at Arequipa and then at Flagstaff during the past few years have resulted in the knowledge of the conditions which constitute good or bad seeing, and have thus enabled an absolute scale to be constructed.

5. *The Criterion.*—The basis of the matter lies in the discovery that systems of waves traverse the air, several of these systems being present at once at various levels above the Earth's surface. The waves composing any given system are constant in size, and differ for the different currents all the way from a fraction of an inch to several feet in length. If the wave be less than the diameter of the object-glass from crest to crest the image is confused by the unequal refraction from the different phases of the wave. If the wave be longer than this a bodily oscillation of the whole image results. The first is fatal to good definition; the second to accurate micrometric measurement.

It is possible to see these waves by taking out the eyepiece and putting one's eye in the focus of the instrument when the tube is pointed at some sufficiently bright light. It is further possible to measure their effect by careful noting of the character of the spurious disc and rings made by a star and the extent of the swing of the image in the field of view. By combining the amount of confusion with the degree of bodily motion of the resulting image the definition at any time and place can be accurately and absolutely recorded.

The increasing perfection of the optical image of a star testifies to the increasing lack of damaging currents with reference to the object-glass used. It records all the waves below a certain wave-length. Similarly the amount of bodily motion registers all those above that length. The two taken together give account of all the currents independent of the glass.

6. *The Scale.*—It is therefore necessary only to agree upon some size of glass for making the fundamental tests and then to reduce the results to any aperture by relations which will be found set forth in a pamphlet by Mr. Douglas made at this observatory, entitled "Scales of Seeing."

The most feasible size for comparison purposes seems the 6-inch aperture.

The scale it is proposed to adopt is therefore as follows :—

With a 6-inch glass—

- o Disc and rings confused and enlarged.
- 2 Disc and rings confused but not enlarged.
- 4 Disc defined ; no evidence of rings.
- 6 Disc defined ; rings broken but traceable.
- 8 Disc defined ; rings complete but moving.
- 10 Disc defined ; rings motionless.

Synchronous determination of the amount of bodily motion of image in seconds of arc.

Expedition for the Ascertaining of the best Location of Observatories. By Percival Lowell.

(Communicated by the Secretaries.)

In order to discover the best place or places for the location of telescopes in the future it is proposed to send observers furnished with similar instruments and identical instructions to all promising parts of the Earth's surface.

Two desert belts girdle the Earth in the sub-tropical regions of *Capricorn* and *Cancer*, and from the meteorologic conditions there prevailing these belts offer the greatest promise to the astronomer. In the northern hemisphere the belt shows itself first in the Sahara of Africa, then in Arabia, then in the desert of Gobi, and crossing the Pacific crops out again in Arizona and Mexico. Of these the two with the greatest height for their plateaux are Arizona and Mexico and the desert of Gobi. In the southern hemisphere we have the veldt of southern Africa, the western part of Australia, and finally the west coast of Peru and Bolivia. Of these the last is the highest and the Transvaal the next.

With regard to these places we have the most systematic series of records from Arizona, the next so from Peru, some slight knowledge of the Sahara, and next to none of any other locality.

Although the desert belts promise the best, other localities widely different should also be examined. Chief among these perhaps are the islands of the Pacific.

It is desirable, therefore, to send out observers somewhat as follows :

1. To the desert of Gobi.
2. To the veldt of the Transvaal.
3. To the Samoan Islands.

The observations made at these points could then be repeated elsewhere till the Earth's surface should be known from an astro-nomic point of view.